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Distinctions between *Euphorbia lasiocaula* Boiss. and *E. pekinensis* Rupr. (Euphorbiaceae)

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Euphorbia lasiocaula Boiss. and *E. pekinensis* Rupr. are distinct from each other. Characteristics and nomenclature for these species are clarified. Three new combinations for intraspecific taxa of these species, i.e., *E. lasiocaula* f. *maritima*, *E. lasiocaula* var. *ibukiensis* and *E. pekinensis* subsp. *fauriei*, are proposed and a new subspecies, *E. pekinensis* subsp. *asoensis*, is described.

Euphorbia lasiocaula Boiss. and *E. pekinensis* Rupr. are polymorphic perennial herbs distributed in eastern Asia. *Euphorbia lasiocaula* was described from Japan by Boissier (1866) as a plant with dense, white hairs on the stems and with glabrous inflorescences. Maximowicz (1883) considered this species to be identical with *E. pekinensis*, and Hayata (1904), Hara (1935, 1954) and Hurusawa (1940) followed his treatment. Hurusawa (1954), however, found differences between them in the branching pattern, shape of verrucae on the ovary and size of seeds. He treated them as distinct species, i.e., *Galarhoeus lasiocaulus* (Boiss.) Hurusawa and *G. pekinensis* (Rupr.) Hara. But, recent taxonomical and floristic works treat *E. lasiocaula* as a synonym of *E. pekinensis* (e.g., Ohwi 1965a, 1965b, Hurusawa 1982, Kitagawa 1983, Wu and Ma 1992) or a variety of the latter (Kitamura and Murata 1961).

In our previous paper (Kurosawa and Ohashi 1994), we recognized *Euphorbia lasiocaula* and *E. pekinensis* to be distinct as treated by Hurusawa (1954). We found, moreover, phenological differences between them in addition to the morphological differences found by Hurusawa mentioned above. The main stems of *E. pekinensis* flowers in spring, and the lateral shoots produced from the main stems flower from late spring to summer, while *E. lasiocaula* flowers from summer to fall. The differences between these two species are summarized in the key below. Nomenclature and intraspecific taxa of *E. lasiocaula* and *E. pekinensis* are also critically revised in this paper.

Key to the species and intraspecific taxa of *Euphorbia lasiocaula* and *E. pekinensis*

1. Verrucae on the capsule semiglobose; stems hairy; beginning of the flowering in summer .... *E. lasiocaula*
2. Aerial stems solitary to several from the rhizome, usually with no lateral shoots or small shoots bearing no pleiochasia; stem leaves elliptic to narrowly elliptic, (1.7–) 3.0–7.0 (–11.0) cm long ..... var. *lasiocaula*
3. Flowering stems (16–) 50–190 (–210) cm long ..... f. *lasiocaula*

3. Flowering stems (5.5–) 10–25 (–61.5) cm long; growing only at seasides ..... f. *maritima*

2. Aerial stems several to many from the rhizome, (6.5–) 10–50 (–55) cm long when flowering, sometimes with lateral shoots bearing pleiochasia; stem leaves elliptic, 1.5–3.0 (–3.7) cm long; endemic to Mt. Ibuki-san and Mt. Kanmuri-dake ..... var. *ibukiensis*

1. Verrucae on the capsule conical; beginning of the flowering in spring ..... *E. pekinensis*

2. Stems with long lateral shoots bearing well developed pleiochasia ..... subsp. *pekinensis*

2. Stems without lateral shoots or sometimes with small ones without pleiochasium

3. Flowering stems 10–30 (–53.5) cm long, hairy or glabrous; stem leaves 1.4–3.0 cm long, 0.5–1.0 cm wide ..... subsp. *fauriei*

3. Flowering stems 30–90 cm long, hairy; stem leaves 4.5–7.2 cm long, 1.3–1.8 cm wide ..... subsp. *asoensis*

Taxonomic treatments

Euphorbia lasiocaula Boissier in DC., Prodr. **15**(2): 1266 (1866); Kurosawa and Ohashi in J. Jpn. Bot. **69**: 9 (1994), which see for further references. Type: Japan. Kyushu, prope Nagasaki (Siebold, not seen).

var. **lasiocaula.**

f. **lasiocaula** (Figs. 1a, b).

Synonyms and their bibliography cited by Kurosawa and Ohashi (1994) under *E. lasiocaula* Boiss. are excluded.

Euphorbia subulatifolia Hurusawa in J. Jpn. Bot. **16**: 573 (1940). Holotype: Korea, Jonranam, Mokpo, Mt. Yudal-san (T. Nakai s. n., Jun. 14, 1921, TI). The holotype was cited as "Corea, prov. Zen-nan, prope Moppo, in monte Yudal-san" in the original description.

E. hakutosanensis Hurusawa, l. c. 581 (1940). Holotype: Korea, Hamgyong, Mt. Pekdu-san (T. Mori s. n., Aug., 1913, TI). This specimen was cited as "Corea, prov. Kanhoku, circa montem Hakuto-zan vel Paik-tu-san" in the original description.

E. pekinensis Rupr. var. *genuina* Hurusawa f. *obtusata* Hurusawa, l. c. 637 (1940). Holotype: Korea, Jonranam, Muan, Chonggye-myeon (T. Nakai s. n., Jun. 15, 1921, TI). The holotype was cited as "Corea, prov. Zen-nan, Seikei-men. (T. Nakai, Jun. 15, 1921)" in the original description.

E. pekinensis var. *hupehensis* Hurusawa f. *ensifolia* Hurusawa, l. c. 642 (1940). Holotype: China, Jiangxi, Jiujiangfu, in or around Lu-shan (Collector unknown, Jul. to Aug. 1908, TI). The specimen was cited as "prov. Kiangsi, Kiukiang, prope Lushan" in the original description.

E. pekinensis var. *attenuata* Hurusawa, l. c. 642, fig. 42 (1940). Lectotype (designated here); China, Zhejiang, Hangzhou, Mt. ?-shan (A. Honda, Jun. 18, 1910, TI). The type specimen was cited as "China, prov. Chekiang, Hang-cheu, in monte Cheuyao-shan. (A. Honda, 1910)" in the original description. It is composed of two sheets in TI. We chose one of them shown in figure 42 in Hurusawa (1940) as the lectotype.

Galarhoeus pekinensis (Rupr.) Hara subsp. *pekinensis* var. *attenuatus* (Hurusawa) Hurusawa in J. Fac. Sci. Univ. Tokyo, III, **6**: 255 (1954).

G. pekinensis subsp. *barbellatus* (Hurusawa) Hurusawa var. *subulatifolius* (Hurusawa) Hurusawa, l. c. 258 (1954).

G. hakutosanensis (Hurusawa) Hurusawa, l. c. 261 (1954).

E. pekinensis var. *subulatifolia* (Hurusawa) T. Lee in J. Nat. Acad. Sci. Rep. Korea **21**: 196 (1982), ut var. *subulatifolius*.

E. pekinensis auct. non Rupr.: Maximowicz in Bull. Acad. Sci. St. Pét. **29**: 198 (1883), p. p.; Forbes et Hemsley in J. Linn. Soc. Bot. **26**: 415 (1894), p. p.; Komarov, Fl. Mansh. **2**: 689 (1904), p. p.; Yabe, Icon. Fl. Manch. **1**(2): pl. 14 (1920), p. p.; Kitagawa, Lineam. Fl. Mansh. 304 (1939), p. p.; Noda, Fl. N.-E.

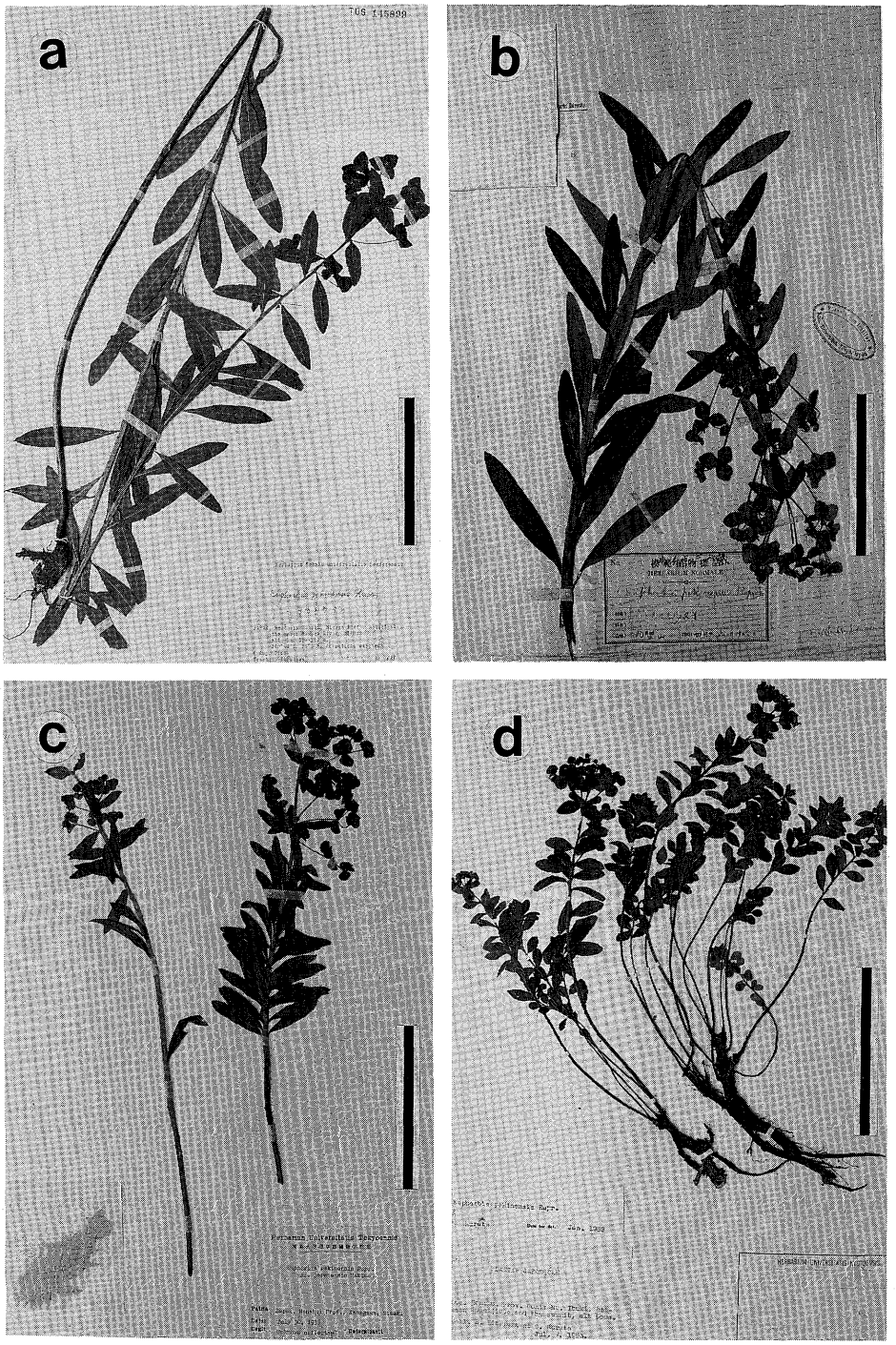

Fig. 1. Variation of *Euphorbia lasiocaula* Boiss. a–b. var. *lasiocaula* f. *lasiocaula* (a. T. Kurosawa 833, TUS; b. A. Honda s. n., 18 Jun. 1910, TI). c. var. *lasiocaula* f. *maritima* (Hurusawa) T. Kurosawa et H. Ohashi (Collector unknown, 30 Jul. 1939, TI). d. var. *ibukiensis* (Hurusawa) T. Kurosawa et H. Ohashi (S. Kitamura and G. Murata s. n., 7 Jul. 1953, KYO). Scale bars = 10 cm.

Prov. China 751 (1971), p. p.; Ma et Wu in Acta Bot. Yun. **14**: 368 (1992), p. p.

G. pekinensis (Rupr.) Hara: Chung, Korean Fl. **2**: 390 (1957).

G. hakutosanensis (Hurusawa) Nakai in Bull. Nat. Sci. Mus. **31**: 70 (1952), nom. nud.

G. subulatifolius (Hurusawa) Nakai, l. c. 70 (1952), nom. nud.

Habitat: In grasslands or on forest margins of hills or mountains.

Distribution: China, Korea and Japan (except Hokkaido).

Japanese name: Takatoudai.

A perennial herb. Stems deciduous, solitary to several from a thick rhizome, erect, (16–) 50–190 (–210) cm long when flowering, pubescent, usually with no lateral shoots or small shoots with no pleiochasia. Leaves sessile, exstipulate; stem leaves many, alternate, elliptic to narrowly elliptic, serrulate but rarely entire, acute or acuminate at apex, cuneate at base, glabrous or pilose on undersurface, (1.7–) 3.0–7.0 (–11.0) cm long, 0.5–1.5 (–2.0) cm wide; verticillate leaves (3–) 5 (–8), elliptic, rhombic or widely ovate, entire or serrulate, acute at apex, obtuse at base, usually glabrous on undersurface, (1.0–) 1.5–3.5 (–4.5) cm long, 0.4–1.0 (–1.6) cm wide; the first bract leaves 2 or 3 (or rarely more), widely ovate; other bract leaves 2, widely ovate. Cyathia in terminal and some lateral pleiochasia; involucre ca. 2 mm diameter, ca. 2 mm high; glands 4 or 5, without appendages, transversely elliptic, green (but dark brown or dark purple in herbarium specimens), ca. 1.5 mm across; lobes irregularly toothed; bracteoles oblanceolate, fringed. Capsules obloid, ca. 3.5 mm across, with 6 longitudinal series of obtuse verrucae, glabrous. Seeds carunculate, smooth, black, broadly ellipsoid, ca. 2 mm long, ca. 1.8 mm wide. Flowering from summer to fall.

Specimens examined: CHINA. HEBEI: Xiaowutai, Badaling (I. Nagai s. n., Jul. 1915, TI). SHANDONG: Jinan (M. Togashi 2278 KYO). SHANGHAI: Shanghai (K. Kimura s. n., early Jul. 1937, KYO). ZHEJIANG: Hangzhou, Mt. ?-shan (A. Honda, 18 Jun. 1910, TI – lectotype of *E. pekinensis* var. *attenuata* Hurusawa). JIANGXI: Jiujiang, in or around Mt. Lu-shan (Collector unknown, Jul.–Aug. 1908, TI – holotype of *E. pekinensis* var. *hupehensis* f. *ensifolia* Hurusawa). HUNAN: Xinning, Ziyunshan (Z. Li et al. 550, KYO). **KOREA.** HAMGYONG: Mt. Pekdu-san (T. Mori s. n., Aug., 1913, TI – holotype of *E. hakutosanensis* Hurusawa). CHUNGCHONG-NAM: Anmyun-do Isl. (T. B. Lee & M. Y. Cho s. n., 1 Jul. 1965, TI). JONRANAM: Ji-do Isl. (T. Nakai s. n., 19 Jun. 1921, TI); Mokpo, Mt. Yudal-san (T. Nakai s. n., 14 Jun. 1921, TI – holotype of *E. subulatifolia* Hurusawa); Muan, Chonggye-myeon (T. Nakai s. n., 15 Jun. 1921, TI – holotype of *E. pekinensis* var. *genuina* f. *obtusata* Hurusawa); Yongam, Mt. Wolchul-san (H. D. Chang s. n., 25 Jun. 1936, TNS). **JAPAN.** Specimens from Japan were enumerated in Kurosawa and Ohashi (1994).

f. **maritima** (Hurusawa) T. Kurosawa et H. Ohashi, comb. nov. (Fig. 1c).

Galarhoeus lasiocaulus (Boiss.) Hurusawa var. *lasiocaulus* f. *maritimus* Hurusawa in J. Fac. Sci. Univ. Tokyo, III, **6**: 264 (1954), ut f. *maritimus* (Hara) Hurusawa. The type was "Prov. Kadzusa, Daito (K. Hisauti, 1934)", but this specimen is not found in TI and TNS. Although not designated, the type was possibly kept in the herbarium of Research Institute for Natural Resources, where was known to have a rich collections of the late K. Hisauti. The herbarium was destroyed during the World War II. The neotype must be selected. Neotype: Japan, Kanagawa Pref., Misaki (Collector unknown, Jul. 30, 1939, TI).

G. pekinensis (Rupr.) Hara f. *maritima* Hara in J. Jpn. Bot. **11**: 386, fig. 14C (1935), nom. nud.

Tithymalus pekinensis var. *onoei* f. *maritimus* Hara: Illegitimate name made by Sugimoto, Keys Herb. Pl. Jap. **1**: 316 (1965).

Flowering stems (5.5–) 10–25 (–61.5) cm long, rarely with lateral shoots at middle and lower nodes. Leaves thicker than f. *lasiocaula*.

Habitat: On seashores.

Distribution: Japan. Kyushu and Honshu.

Japanese name: Hama-takatoudai (Sugimoto 1965).

Specimens examined: JAPAN. CHIBA: Choshi-shi, Inubou (Y. Fukuda & H. Ohba 7506, TI). KANAGAWA: Miura-shi, Kenzaki (S. Kobayashi s. n., 25 Jun. 1961, MAK), (S. Kobayashi s. n., 28 Jul. 1965, MAK); Miura-shi, Misaki (Collector unknown, 30 Jul. 1939, TI – neotype of *G. lasiocaulus* f. *maritimus* Hurusawa), (A. Watanabe s. n., 15 Jul. 1923, MAK); Miura-shi, Natsuse (T. Makino s. n., Aug. 1923, KYO); Miura-shi, Wadakaigan (T. Makino s. n., Aug. 1923, MAK). SHIZUOKA: Ishimuro-saki (Z. Tashiro s. n., 5 Aug. 1927, KYO). MIE: Daioh-cho, Daioh-zaki (K. Deguchi 5771, KYO). NAGASAKI: Ashibe-cho, Yahata (S. Watanabe 6, KYO).

var. **ibukiensis** (Hurusawa) T. Kurosawa et H. Ohashi, comb. nov. (Fig. 1d).

Euphorbia pekinensis Rupr. var. *ibukiensis* Hurusawa in J. Jpn. Bot. **16**: 639 (1940); in Nakai, Icon. Pl. As. Orient. **4**: 402 (1942); in Wild Flow. Jap. Herb. Pl. **2**: 227 (1982). Holotype: Japan, Kinki, Prov. Ohmi, at the summit of Mt. Ibuki-san (J. Matsumura, Aug. 1, 1881, TI). The collector of the holotype is not written on the label, but is J. Matsumura according to Hurusawa (1940, 1954).

Tithymalus pekinensis (Rupr.) Hara var. *ibukiensis* (Hurusawa) Hara, Enum. Sperm. Jap. **3**: 55 (1954); Sugimoto, Keys Herb. Pl. Jap. **1**, Dicot. 316 (1965).

Galarhoeus lasiocaulus (Rupr.) Hurusawa var. *ibukiensis* (Hurusawa) Hurusawa in J. Fac. Sci. Univ. Tokyo, III, **6**: 265 (1954).

E. pekinensis auct. non Rupr.: Makino, Iinuma Yokusai Somoku-Dzusetsu, Herb. Pl. **2**: 705, pl. 17 (1910), p. p.; Ohwi, Fl. Jap. 593 (1953), p. p.; l. c. ed. Engl. 593 (1965), p. p.; l. c. ed. rev. 840 (1965), p. p.; Kitagawa, Ohwi New Fl. Jap. 948 (1983), p. p.

E. pekinensis var. *japonensis* auct. non Makino: Kitamura et Murata, Col. Illust. Herb. Pl. Jap. (Choripetalae) 80 (1964), p. p.

Stems several to many from a thick rhizome, erect or ascendent, (6.5–) 10–50 (–55) cm long when flowering, sometimes with lateral shoots at middle and lower nodes. Stem leaves about 10–30, glabrous on undersurface, 1.5–3.0 (–3.7) cm long, 0.5–1.0 (–1.5) cm wide.

Habitat: On open rocky places of limestone areas.

Distribution: Japan. Endemic to Mt. Ibuki-san and Mt. Hira-san.

Japanese name: Ibuki-taigeki.

Var. *ibukiensis* has numerous small aerial stems with small leaves from a well-developed rhizome. These features did not change through transplantation from its original habitat to the University of Tokyo, Tokyo (Hurusawa 1942, 1954). No differences are observed between var. *lasiocaula* and var. *ibukiensis* in the flowers, fruits and seeds.

Specimens examined: JAPAN. GIFU: Fujihashi-mura (G. Murata et al. 56932, KYO); Mt. Hira-san (I. Sono s. n., 23 Jul. 1907, TNS); Kasuga-mura, Mt. Ibuki-san (J. Murata 15319, TI). SHIGA: Ibuki-cho, Mt. Ibuki-san (J. Matsumura, 1 Aug. 1881, TI – holotype of *E. pekinensis* var. *ibukiensis* Hurusawa), (M. Hiroe 13821 & 16544, KYO), (K. Hisauchi s. n., 14 Aug. 1935, TI), (K. Inami s. n., 11 Aug. 1956, TNS), (M. Ito & H. Nagamasu 3118, KYO), (H. Kanai & T. Morita s. n., 23 Jun. 1971, TNS, TUSG), (T. Kato 3026, KYO), (G. Koidzumi s. n., 26–27 Jun. 1922, KYO, MAK), (G. Koidzumi s. n., 20 Aug. 1922, MAK), (T. Makino s. n., 1931, KYO, MAK), (G. Murata s. n., 8 Jul. 1956, KYO), (G. Nakai 3363, KYO), (S. Saito s. n., 8 Jun. 1929, TI).

Euphorbia pekinensis Rupr. in Maxim., Prim. Fl. Amur. 239 (1859); Boissier in DC. Prodr. **15**(2): 121 (1862); Maxim. in Bull. Acad. Sci. St. Pét. **29**: 198 (1883), p. p., excl. syn. cit. *E. lasiocaula*; Forbes et Hemsley in J. Linn. Soc. Bot. **26**: 415 (1894), p. p.; Komarov, Fl. Mansh. **2**: 689 (1904), p. p.; Yabe, Enum. Pl. S. Manch. 86 (1912); Yabe, Icon. Fl. Manch. **1**(2) pl. 14 (1920), p. p.; Kitagawa, Lineam. Fl. Mansh. 304 (1939), p. p.; Noda, Fl. N.-E. Prov. China 751 (1971), p. p.; Kitagawa, Neo Lineam. Fl. Mansh. 429 (1979); Ma et Wu in Acta Bot. Yunnan. **14**: 368 (1992), p. p.

Galarhoeus pekinensis (Rupr.) Hara in J. Jpn. Bot. **11**: 386 (1935), p. p.

Tithymalus pekinensis (Rupr.) Hara, Enum. Sperm. Jap. **3**: 55 (1954), p. p.

subsp. **pekinensis** (Figs. 2a, b).

Euphorbia imaii Hurusawa in J. Jpn. Bot. **16**: 576 (1940). Holotype: Korea, Pyongannam, Pyongyang

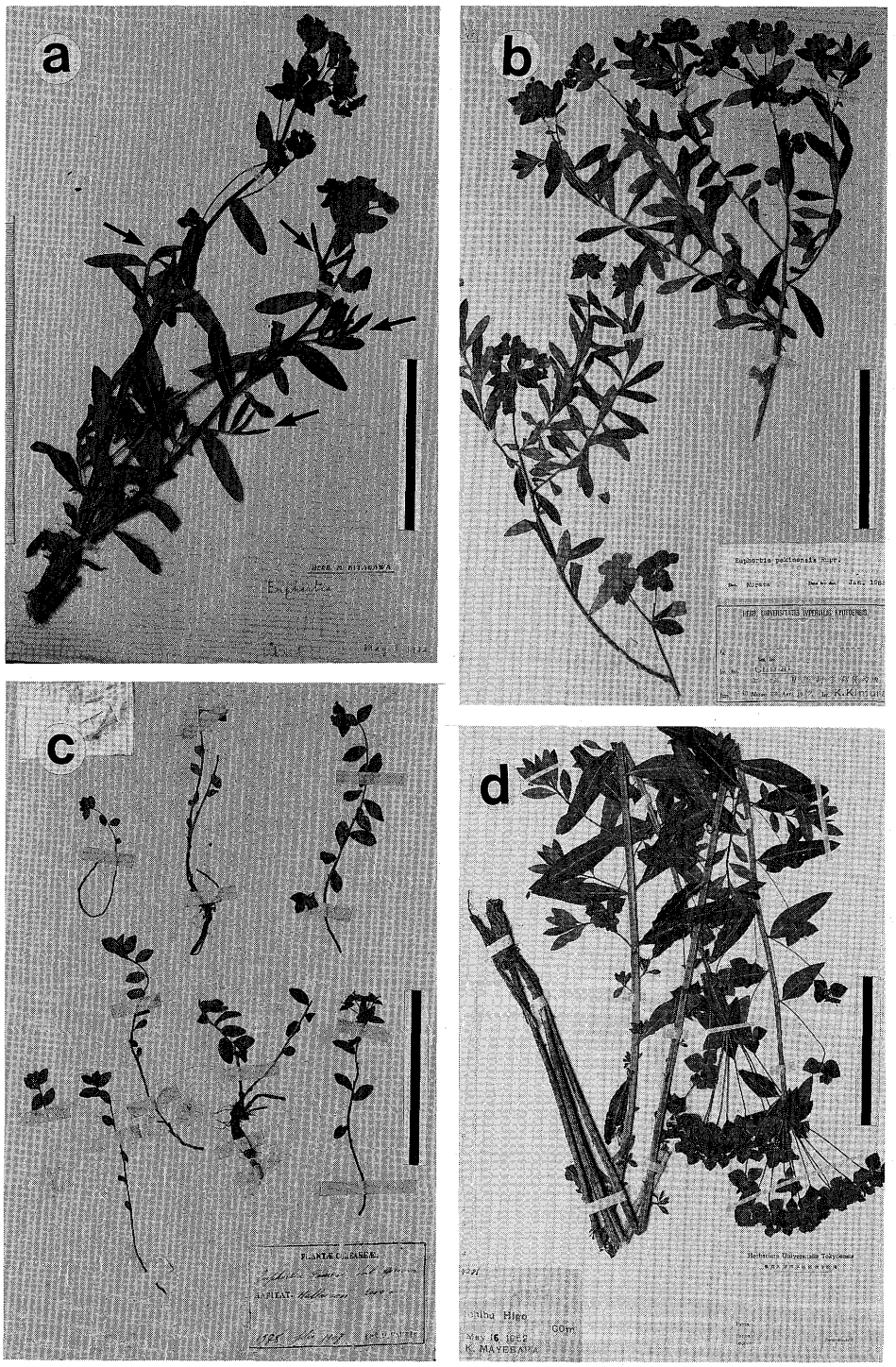

Fig. 2. Variation of *Euphorbia pekinensis* Rupr. a. subsp. *pekinensis* at the flowering period of the main stem (M. Kitagawa s. n., 3 May 1932, TI), with arrows indicating lateral shoots. b. subsp. *pekinensis* at the flowering period of the lateral shoots (K. Kimura s. n., Jul. 1937, KYO). c. subsp. *fauriei* (Lév. et Vant.) T. Kurosawa et H. Ohashi (H. Faurie 1978, TI). d. subsp. *asoensis* T. Kurosawa et H. Ohashi (K. Mayebara s. n., 16 May 1952, TI). Scale bars = 10 cm.

(H. Imai s. n., May 14, 1911, TI). This specimen was cited as "Corea, prov. Heinan, Heizyo" in the original description.

E. imaii f. *denudata* Hurusawa, l. c. 577 (1940). Lectotype (designated here): China, Liaoning, Lingshuisi (M. Kitagawa s. n., May 3, 1932, TI). The type cited by Hurusawa (1954) is "prov. Fentieng, Ling-shuei-szu. (M. Kitagawa, 1932)", but is composed of three herbarium sheets in TI. One of them are cited as *E. imaii* in fig. 25 by Hurusawa (1940). We selected one of the remaining two as the lectotype, because the specimen is well match the original description.

Galarhoeus pekinensis (Rupr.) Hara var. *pekinensis*: Hurusawa in J. Fac. Sci. Univ. Tokyo, III, **6**: 255 (1954).

G. pekinensis subsp. *barbellatus* (Hurusawa) Hurusawa var. *barbellatus*: Hurusawa, l. c. 257 (1954).

G. pekinensis subsp. *barbellatus* var. *imaii* (Hurusawa) Hurusawa f. *imaii*: Hurusawa, l. c. 259 (1954).

G. pekinensis subsp. *barbellatus* var. *imaii* f. *denudatus* (Hurusawa) Hurusawa, l. c. 259 (1954).

E. hurusawae Oudejans in Phytologia **67**: 46 (1989).

E. hurusawae var. *imaii* (Hurusawa) Oudejans, l. c. 46 (1989).

E. barbellata Hurusawa, l. c. 571 (1940), non G. Engelmann (1858). Holotype: China, Jilin, Daheshangshan (M. Nishimura s. n., Jun. 1, 1913, TI). The holotype was cited as "Manshuria, prov. Kwangtung, in monte Dai-osyo-zan" in the original description.

Distribution: China and Korea.

Japanese name: Tou-takatoudai.

A perennial herb. Stems deciduous, solitary to several from a thick rhizome, erect, (15–) 25–50 (–60) cm long when flowering, glabrous or pubescent, with lateral shoots at middle and lower nodes. Lateral shoots with well-developed pleiochasia and sometimes with secondary lateral shoots, usually exceeding the main stem. Leaves sessile, exstipulate; stem leaves several to about twenty, alternate, spathulate, elliptic or narrowly elliptic, entire or serrulate, acute or obtuse at apex, attenuate to cuneate at base, glabrous or pilose at undersurface, 1.5–11.0 cm long, 0.5–2.0 cm wide; verticillate leaves 5 to 15, elliptic, rhombic or ovate, entire or serrulate, acute or obtuse at apex and base, glabrous or pilose on undersurface, 0.8–7.9 cm long, 0.5–1.8 cm wide; the first bract leaves 2 or 3 (rarely more), ovate to widely ovate; other bract leaves 2, widely ovate. Cyathia in terminal and some lateral pleiochasia of the main stem and some lateral shoots; involucre ca. 2 mm diameter, ca. 2 mm high; glands 4 or 5, without appendages, transversely elliptic, ca. 1.5 mm across; lobes irregularly toothed; bracteoles oblanceolate, fringed. Capsule obloid, ca. 3.5 mm across, with 6 longitudinal series of acute verrucae, glabrous but rarely pilose. Seeds carunculate, smooth, broadly ellipsoid, ca. 2 mm long, ca. 1.8 mm wide. Flowering in spring on the main stems and in summer on the lateral shoots.

Specimens examined: CHINA. HEILONGJIANG: Jingpohu Lake (M. Takahashi s. n., 25 to 29 May, TNS); Mudanjiang (T. Teramachi s. n., 21 May 1941, KYO). JILIN: Mt. Daheshangshan (M. Nishimura s. n., 1 Jun. 1913, TI – holotype of *E. barbellata* Hurusawa). LIAONING: Andong (Collector unknown, May 1914, MAK); Changtu (Collector unknown, 5 Jun. 1931, TNS); Lingshuisi (M. Kitagawa s. n., 3 May 1932, TI – including lectotype of *E. imaii* f. *denudata* Hurusawa), (M. Kitagawa s. n., 2 May 1926, TI), (Yamatsuta 1990, TNS). HEBEI: Beiyinfang to Xinglong (T. Nakai et al. s. n., 28 Aug. 1933, TI); Hsiang Shan (G. Mathews s. n., 5 May 1936, TI); Xianglong to Qiangzilu (T. Nakai et al. s. n., 6 Sep. 1933, TI). SHANDONG: Qingdao (Tsingtao) (M. Nohara s. n., Jul. 1943, KYO); Qingdao (Chintao), Mt. Rokunto (S. Miki s. n., 25 Aug. 1940, KYO). BEIJING: Juyongguan (Kyoyokuwan) (M. Togashi 549, TI), (M. Togashi s. n., 29 May 1942, TI, TNS). SHANGHAI: Shanghai (K. Kimura s. n., late Jul. 1937, KYO). ANHUI: Yinjiahui (F. Maekawa s. n., 5 Mar. 1940, TI), (F. Maekawa s. n., 8 Mar. 1940, TI), (F. Maekawa s. n., 5 Apr. 1940, TI), (F. Maekawa s. n., 9 Apr. 1940, TI). **KOREA.** PYONGANPUK: Uiju to Okkang-jin (T. Nakai s. n., 3 Jun. 1914, TI). PYONGANNAM: Pyongyang (H. Imai s. n., 14 May 1911, TI – holotype of *E. imaii* Hurusawa). WHANGHAEPUK: Sehung (N. Kutani s. n., 24 May 1940, TI). WHANGHAENAM: Jangsan-got (T. Nakai s. n., 27 Jul. 1929, TI). JONRANAM: Nalo-do Isl. (H. D. Chang s. n., 22 Jun. 1938, TNS); Muan,

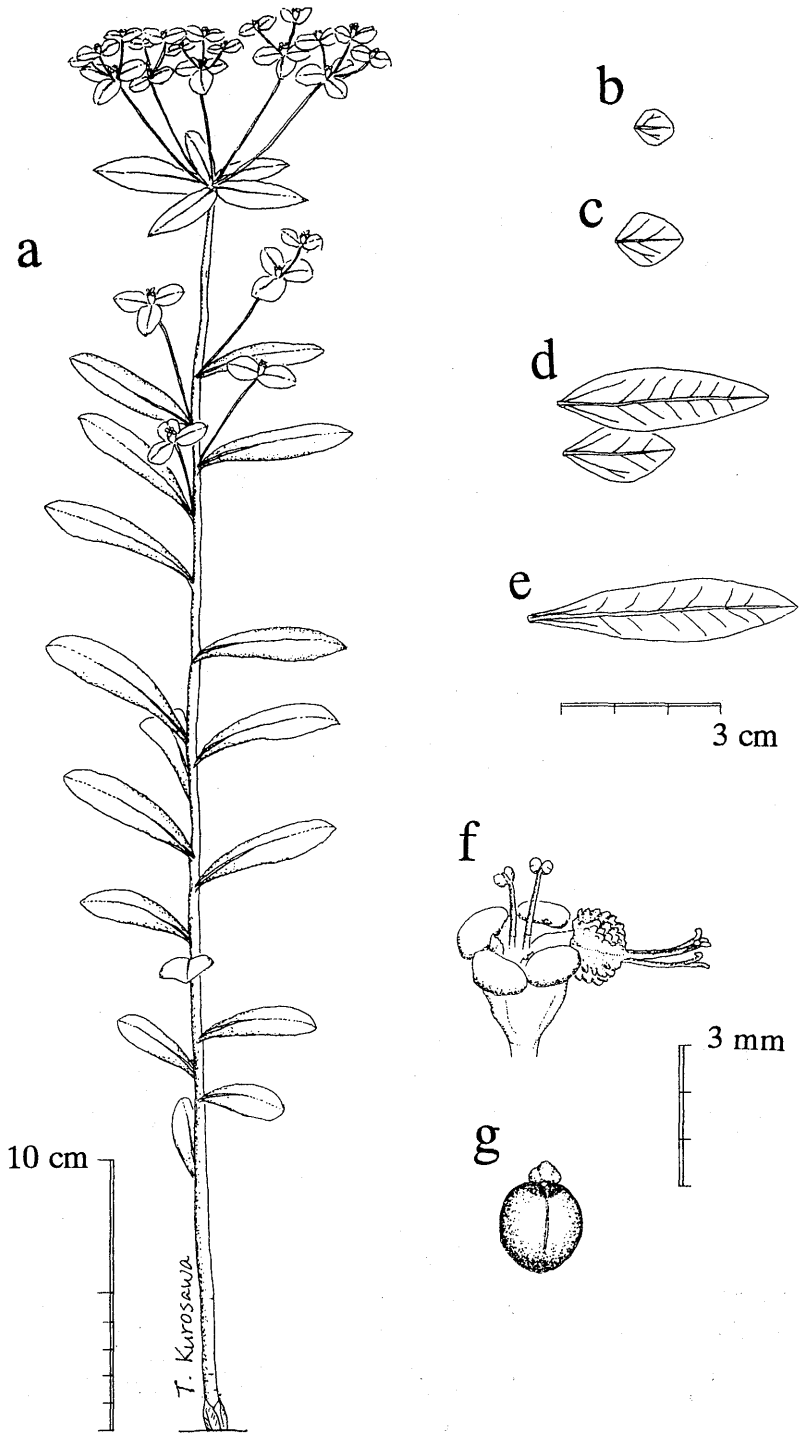

Fig. 3. *Euphorbia pekinensis* Rupr. subsp. *asoensis* T. Kurosawa et H. Ohashi. a. habit; b. second bract leaf; c. first bract leaf; d. verticillate leaf; e. stem leaf; f. cyathium in male stage; g. seed. Drawn from T. Kurosawa 4296 (a–e), T. Kurosawa 4295 (f), and Y. Shimada s. n., 11 Jul. 1965 (g).

Hyongyong-myeon (T. Nakai s. n., 16 Jun. 1921, TI). GYONGSANGNAM: Mt. Jili-san (Tii) (S. Okamoto s. n., 14 Jun. 1935, KYO); Busan (T. Nakai s. n., 29 Apr. 1928, TI).

subsp. **fauriei** (Lév. et Vant.) T. Kurosawa et H. Ohashi, comb. nov. (Fig. 2c).

Euphorbia fauriei Léveillé et Vant. in Fedde Repert. Sp. Nov. Veg. **5**: 281 (1908). Isotype: Korea, Jeju, Mt. Halla-san (Hallaisan), 2000 m (U. Faurie 1978, TI).

E. pekinensis var. *fauriei* (Lév. et Vant.) Hurusawa in J. Jpn. Bot. **16**: 638 (1940); in Nakai, Icon. Pl. As. Orient. **4**: 399 (1942).

Galarhoeus pekinensis subsp. *fauriei* (Lév. et Vant.) Hurusawa in J. Fac. Sci. Univ. Tokyo, III, **6**: 259 (1954).

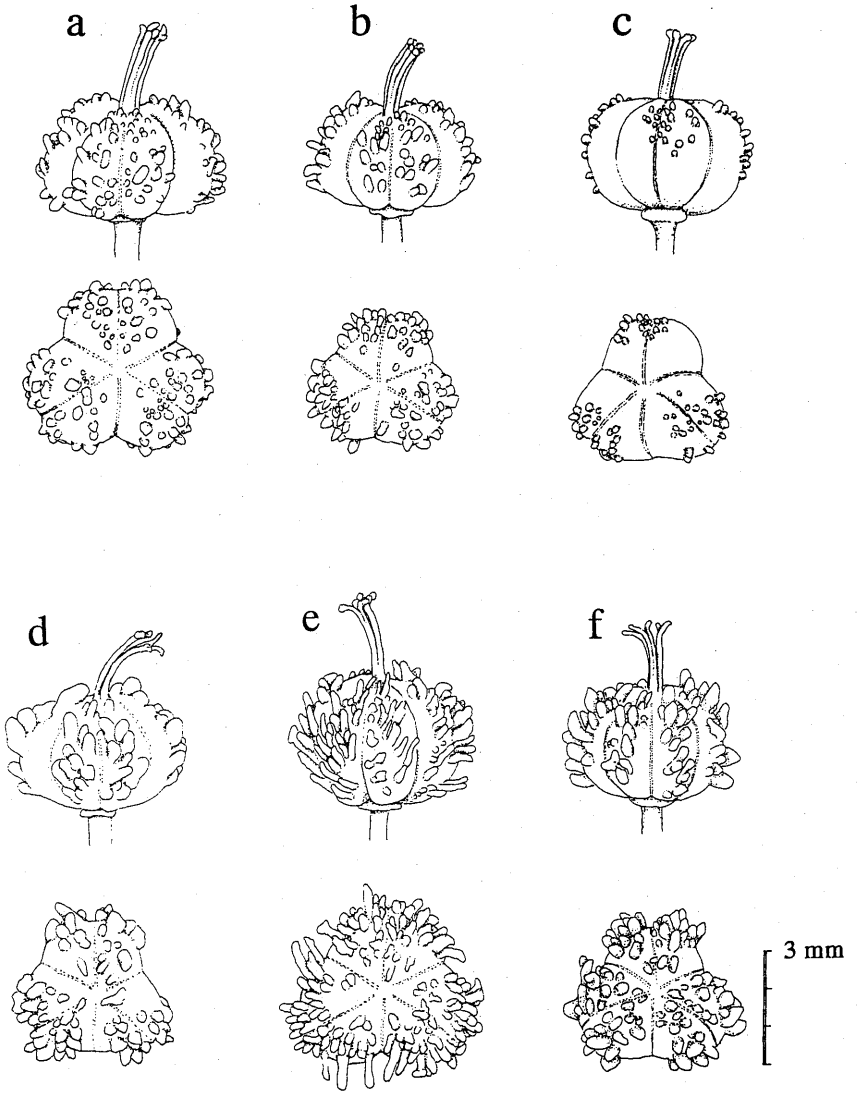

Fig. 4. Variation of verrucae of capsules of *Euphorbia lasiocaula* f. *lasiocaula* (a–c) and *E. pekinensis* subsp. *asoensis* (d–f) in Mt. Aso-san. The upper is lateral view and the lower is upper view (styles omitted). Voucher specimens: T. Kurosawa 4290 (a), T. Kurosawa 4289 (b), T. Kurosawa 4288 (c), T. Kurosawa 4296 (d), T. Kurosawa 4295 (e) and T. Kurosawa 4294 (f).

G. pekinensis subsp. *fauriei* var. *intermedius* Hurusawa, l. c. 260 (1954). Holotype: Korea, Jeju (Quelpaert), Yengtil, 1000 m (T. Taquet 5945, TI).

G. fauriei (Lév. et Vant.) Nakai in Bull. Nat. Sci. Mus. **31**: 69 (1952), nom. nud.: Chung, Korean Fl. **2**: 386 (1957).

Flowering stems 10–30 (–53.5) cm long, sometimes with lateral shoots at middle and lower parts. Stem leaves 1.4–3.0 cm long, 0.5–1.0 cm wide; verticillate leaves 1.0–2.2 cm long, 0.5–1.0 cm wide. Flowering from spring to early summer.

Distribution: Korea. Endemic to Jeju-do Isl. and Koje-do Isl.

Japanese name: Miyama-taigeki.

Specimens examined: KOREA. GYONGSANGNAM: Goje-do Isl. (T. Mori s. n., Aug. 1912, TI). JEJU: Jeju-do Isl., Mt. Halla-san (U. Faurie 1978, TI – isotype of *E. fauriei* Lévl. et Vant.), (U. Faurie 2026, TI), (M. G. Park s. n., 10 Aug. 1933, KYO), (H. D. Chang s. n., 19 May 1938, TNS); Jeju-do Isl., Sokirii (S. Kitamura s. n., 17 Jul. 1930, KYO); Jeju-do Isl., Yengtil (T. Taquet 5945, TI – holotype of *G. pekinensis* subsp. *fauriei* var. *intermedius* Hurusawa).

subsp. **asoensis** T. Kurosawa et H. Ohashi, subsp. nov. (Figs. 2d, 3).

Euphorbia pekinensis Rupr.: Fl. Kumamoto 256 (1969), p. p.

A typo caulis florifer singulus vel interdum cum brevissimus ramo lateralibus et longior (30–90 cm longus) differt.

Flowering stems 30–90 cm long, pubescent, simple or sometimes with small lateral shoots at the middle or lower parts. Flowering from spring to early summer.

Type: Japan, Kyushu, Kumamoto Pref., Aso-gun, Takamori-machi, between Ohtonokuchi and Minenoshuku, alt. ca. 880m (T. Kurosawa 4296, TUS, holotype).

Habitat: In meadows at medium altitude of mountains.

Distribution: Japan. Endemic to Mt. Aso-san and Hitoyoshi in Kumamoto Prefecture.

Japanese name: Aso-taigeki (nov.).

Euphorbia pekinensis subsp. *asoensis* differs from subsp. *pekinensis* in the length and hairiness of stem and the pattern of branchings. The stem is always pubescent, and produces no lateral shoots or, if any, small one not exceeding the main stem in height and without cyathia. Subsp. *asoensis* and *E. lasiocaula* f. *lasiocaula* occur in Mt. Aso-san, but they are distinguishable in the flowering period, and by the stem length and the shape of verrucae on the capsule (Fig. 4). Subsp. *asoensis* resembles *E. sinanensis* in the habit, but differs from the latter in hairiness of the stem and the shape of verrucae on the capsule (Table 1).

Specimens examined: JAPAN. KUMAMOTO: Aso-gun, Takamori-machi, near Ohtonokuchi (S. Serizawa 52214-1, 52214-2 & 52219, AICH); Aso-gun, Takamori-machi, between Ohtonokuchi and Minenoshuku (T. Kurosawa 4294–4298, TUS – including holotype of *E. pekinensis* subsp. *asoensis* T. Kurosawa et H. Ohashi); Aso-gun, Takamori-machi, Kawara (Y. Shimoda 13667, KYO, excluding the left plant); Aso-gun, Takamori-machi, Yatsuda, Takaono (S. Serizawa 51812, AICH); Ichibu (K. Mayebara s. n., 16 May 1952, TI); Kuma-gun, Kamimura (K. Mayebara s. n., 23 Apr. 1916, TNS).

We are grateful to Dr. S. Serizawa of Aichi Kyoiku University for kind permission to examine his collec-

Table 1. Differences among *Euphorbia pekinensis* subsp. *asoensis*, *E. lasiocaula* f. *lasiocaula*, and *E. sinanensis*

	E. pekinensis ssp. *asoensis*	*E. lasiocaula* f. *lasiocaula*	*E. sinanensis*
Stem length	30–90 cm	(16–) 50–190 (–210) cm	(5–) 10–50 (–110) cm
Verrucae on capsule	acute	obtuse	obtuse
Flowering period	late spring to early summer	summer to fall	spring

tion of *Euphorbia* and valuable suggestion for our studies, and, also, to the curators of TI, MAK, TNS and KYO for permission to examine their specimens. We would like to thank Mr. W. G. Park and Miss B. Ye of our laboratory for native spelling of Korean and Chinese localities and collectors described on the specimens cited in this paper.

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黒沢高秀，大橋広好：**タカトウダイと *Euphorbia pekinensis* Rupr. の区分**

一般に，タカトウダイの学名として *Euphorbia pekinensis* Rupr. が用いられている．しかし，Hurusawa (1954) が指摘したように，タカトウダイはほとんど分枝せず果実の突起が半球形なのに対し，*E. pekinensis* は分枝が著しく，その先端にも花序を付け，果実の突起が円錐形である．これらの違いは種の区別として重要であると考え，われわれは，タカトウダイとシナノタイゲキの分類の再検討を行なった際に，タカトウダイに対して *E. lasiocaula* Boiss. という学名を用いた (Kurosawa and Ohashi 1994)．さらに，本論文では，タカトウダイは常に茎に毛があり，夏から秋咲きであるのに対し，*E. pekinensis* は茎が無毛または有毛で，主茎が春咲き，分枝した側枝が夏咲きであることを明らかにした．これらのことから，タカトウダイと *E. pekinensis* は明らかに別種と考えられる．本論文では，タカトウダイと *E. pekinensis* およびそれらの種内分類群を再検討し，特徴を明らかにし，学名を整理した．

タカトウダイの一形で，海岸に生える葉のやや厚い小型の植物ハマタカトウダイに対し *E. lasiocaula* f. *maritima* (Hurusawa) T. Kurosawa et H. Ohashi，および，伊吹山などの石灰岩上に特産する小型のイブキタイゲキに *E. lasiocaula* var. *ibukiensis* (Hurusawa) T. Kurosawa et H. Ohashi の新組合せを提案した．*E. pekinensis* では，韓国済州島産の小型の植物ミヤマタイゲキに対し *E. pekinensis* subsp. *fauriei* (Lév. et Vant.) T. Kurosawa et H. Ohashi を提案した．

熊本県阿蘇山および人吉地方には，*E. pekinensis* と花部，果実および種子の形態的特徴が同じ植物が生育している．しかし，この植物は，茎は常に有毛で分枝しかないか，分枝しても側枝が主茎よりも高く伸びたり花序をつけたりすることがない点で，中国や朝鮮のものとは異なる．分布的にも隔離しているので，この植物を *E. pekinensis* の亜種と考え，*E. pekinensis* subsp. *asoensis* T. Kurosawa et H. Ohashi と命名して，記載した．和名をアソタイゲキとする．阿蘇山では，アソタイゲキとタカトウダイが隣接して生育するところもあるが，アソタイゲキはタカトウダイに比べて花期がより早いこと，丈がより低いこ

と，および果実の突起が円錐形であることにより，容易に区別ができる．また，アソタイゲキは花期や草形が本州中北部に分布するシナノタイゲキ *E. sinanensis* (Hurusawa) T. Kurosawa et H. Ohashi と似るが，常に茎が有毛で，果実の突起が円錐形であることにより，茎が無毛または有毛で果実の突起が半球形のシナノタイゲキと区別できる．